

## Procedural Sedation in Children—What is Recommended?

Adequate sedation and analgesia are crucial factors in deciding the success of any procedure done in children. Currently, there is no consensus regarding the type of procedure, choice of drug, dosage and giving multiple drugs etc. and hardly any literature covering this important topic is published from India. Sometimes, adequate sedation is not achieved in spite of using full dose and multiple drugs. There is considerable confusion and variation among doctors even from the same hospital. Hospitals with intensive care facility backup can afford to use potent and newer drugs, including anesthetic drugs; but in most of the other places, adequate procedural sedation remains a challenge. All these factors play a key role in causing traumatic and unsuccessful procedures.

What is the general algorithm for procedural sedation in children for simple procedures, which can be universally followed, including resource-limited setups?

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### REPLY

Procedural sedation and analgesia (PSA) refers to the pharmacologic technique of managing a child's pain and anxiety in order to successfully perform a diagnostic or therapeutic procedure safely [1].

The sequential approach to PSA includes defining the goal for sedation, performing a pre-sedation health check-up, assigning a qualified person to administer the sedation, choosing the appropriate drug and appropriate monitoring devices, defining the protocol for monitoring during sedation and the discharge criteria. The same should be followed in all settings.

The goals of PSA [2] are: (i) Maintain patient safety, (ii) Minimize discomfort, (iii) Maximize amnesia, (iv) Control behavior and/or movement for the safe completion of the procedure, and (v) Safe discharge.

#### **Pre-sedation evaluation**

The important components of this evaluation are: Age

and weight; Relevant diseases and Physical abnormalities; Medication history; Allergies; Vital signs; Relevant systemic examination; Focused evaluation of the airway (tonsillar hypertrophy, abnormal anatomy e.g., short neck); Fasting status.

**Fasting status:** The American Society of Anesthesiologists (ASA) recommendations for fasting prior to procedural sedation are commonly followed, which are as follows (3): 2 hours fasting for clear fluids, 4 hours for breast milk, and 6 hours for solid foods, formula, or milk other than human milk.

**Informed consent:** An informed consent should be obtained from the primary caregiver before sedating the child. The components of informed consent include details of the procedure being performed, specific medications that will be administered, and potential adverse effects.

#### **Personnel**

Apart from minimal sedation, all other levels of sedation ideally require at least two trained healthcare professionals [4]. One person is responsible for administering sedation and carrying out the procedure (primary practitioner), while the other person's (assistant) responsibility is to monitor appropriate physiologic parameters and to assist in any supportive or resuscitation measures, if required. The primary practitioner should preferably possess advanced pediatric airway skills and the assistant should be capable of providing pediatric basic life support.

#### **Choice of Drugs**

The choice of drugs (**Table I**) for procedural sedation depends various factors like: type of the procedure, target level of sedation, specific patient profile, skill of the practitioner, and contraindication and side effect profile.

**Sedation for non-painful procedures:** Imaging studies constitute the most common non-painful procedures for which children undergo sedation. The chosen agent or agents should have a quick onset of action, should maintain airway reflexes, and have limited impact on breathing and hemodynamic stability. Analgesia is not necessary for these procedures. Common options for non-painful procedures include sedatives such as midazolam and triclofos. One may also consider using non-pharmacologic approaches.

**TABLE I** RECOMMENDED STRATEGIES FOR PROCEDURAL SEDATION AND ANALGESIA

<i>Procedure</i>	<i>Sedation /Analgesia options</i>	<i>Comments</i>
<i>Non-painful procedures*</i>		
ECG, ECHO, USG	<ul style="list-style-type: none"> <li>• Oral Triclofos</li> <li>• Midazolam (IN/PO/IV/IM)</li> </ul>	Sedation not required routinely
CT, MRI (non-intervention)	<ul style="list-style-type: none"> <li>• IV Midazolam</li> <li>• Propofol</li> </ul>	Propofol infusion is an option for children requiring prolonged sedation for MRI; should be used only under supervision of a specialist
<i>Procedures associated with low level of pain and high anxiety</i>		
Incision and drainage,	<ul style="list-style-type: none"> <li>• Comforting alone</li> </ul>	
Laceration repair, Pleural tap	<ul style="list-style-type: none"> <li>• Midazolam + LA</li> </ul>	
Lumbar puncture	<ul style="list-style-type: none"> <li>• EMLA applied 60 min before procedure + LA + Midazolam</li> <li>• Ketamine</li> <li>• Midazolam + Fentanyl</li> </ul>	Avoid Ketamine in increased ICP
<i>Procedures associated with high level of pain, high anxiety or both</i>		
BMA, Chest tube insertion,	<ul style="list-style-type: none"> <li>• Ketamine (alone or in combination with Midazolam or Propofol)</li> </ul>	Propofol should be used only under supervision of a specialist
Liver/Renal biopsy	<ul style="list-style-type: none"> <li>• Fentanyl + Midazolam</li> </ul>	

\*Do not use ketamine or opioids for non-painful procedures. IV-intravenous, IM-intramuscular, PO-per oral, IN-intranasal, PR-per rectal, ECHO-echocardiography, USG-ultrasonography, LA-local anesthetic, ICP- Intracranial Pressure, BMA- bone marrow aspiration, EMLA- eutectic mixture of local anesthetics.

**Sedation for painful procedures:** For children undergoing painful procedures, adequate sedation as well as analgesia is required. The options for painful procedures include:

1. Ketamine, either alone or in combination with midazolam or propofol,
2. Opioids (e.g., fentanyl) combined with midazolam,
3. Opioids combined with propofol,
4. Nitrous oxide alone

**Table II** provides dosing of the commonly used medications.

#### **Monitoring and Documentation**

Before proceeding with sedation, the practitioner should check the necessary equipment (suction apparatus, oxygen supply, and size appropriate airway equipment), monitors (pulse oximeter and other monitors as appropriate for the procedure like ECG, noninvasive BP) and drugs (the basic life support drugs).

All children undergoing any degree of sedation should be monitored carefully. At a minimum, the vital signs should be measured at baseline, after administration of the drug, on completion of the procedure, during early

recovery, and at the completion of recovery. If an increased depth of sedation is anticipated or the child has an underlying illness, the frequency of measurement of vital signs should be increased (e.g., to every five minutes with deep sedation) [5]. The importance of proper documentation cannot be over-emphasized. The patient's chart should include the name, route, site, time, dosage, and a time based record of patient's vitals until the criteria for safe discharge are attained.

**Discharge criteria:** After procedural sedation, children should be discharged only after they have awakened to their baseline mental and ambulatory status. Discharge instructions should be clearly explained to the caregivers with special emphasis on watching carefully for signs of respiratory distress.

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#### **REFERENCES**

1. Doyle L, Colletti JE. Pediatric procedural sedation and analgesia. *Pediatr Clin N Am.* 2006;53:279-92.
2. American Academy of Pediatrics, American Academy of

**TABLE II** COMMONLY USED PHARMACOLOGICAL AGENTS FOR PEDIATRIC PROCEDURAL SEDATION AND ANALGESIA [5]

<i>Drug</i>	<i>Dose</i>	<i>Onset/Duration</i>	<i>Side effects</i>
Midazolam (S)	IV (0.5-5 yr): 0.0-0.1mg/kg, (May repeat every 2-5min, maximum total dose 6 mg) IV (6-12 yr): 0.025-0.05 mg/kg, (maximum total dose 10 mg) IN: 0.2-0.5 mg/kg	Onset: 2-3 min Duration: 45-60 min	Respiratory depression, hypotension <i>Reversal:</i> Flumazenil
Triclofos (S)	PO: 20 mg/kg/dose	—	Monitor child during and after procedure
Fentanyl (A)	IV: 1.0 $\mu$ g/kg/dose, (May repeat every 3 min, maximum dose 4-5 $\mu$ g/kg)	Onset: 2-3 min Duration: 30-60 min	Respiratory depression, chest wall rigidity (after rapid iv push). <i>Reversal:</i> Naloxone
Ketamine (S/A)	IV: 1-1.5 mg/kg, (May repeat $\frac{1}{2}$ dose every 10 min) IM: 4-5 mg/kg, may repeat after 10 min	Onset: 1-2 min Duration: 15-30 min	Vomiting, increased salivation, laryngospasm, emergence reaction. <i>C/I:</i> Age <3 mo, increased ICP, glaucoma

*S-sedative, A-analgesic, IV-intravenous, IM-intramuscular, PO-per oral, IN-intranasal, C/I-contraindications, ICP-Intracranial Pressure*

Pediatric Dentistry, Coté CJ, Wilson S. Guidelines for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures: an update. Pediatrics. 2006;118:2587-2602.

3. American Society of Anesthesiologists. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary

aspiration: applications to healthy patients undergoing elective procedures. Anesthesiol. 1999;90:896-905.

4. NICE Clinical Guideline 112. Sedation in children and young people. 2010. Available at: <http://www.nice.org.uk/nicemedia/live/13296/52124/52124.pdf>. Accessed on 21 January, 2013.
5. Krauss B, Green SM. Sedation and analgesia for procedures in children. N Engl J Med. 2000;342:938-45.